West George Street Primary Fault Level Mitigation

ED2 Engineering Justification Paper

ED2-LRE-SPD-003-CV3-EJP

Issue	Date	Comments
Issue 0.1	Jan 2021	Issue to internal governance and external assurance
Issue 0.2	Apr 2021	Reflecting comments from internal governance
Issue 0.3	May 2021	Reflecting external assurance feedback
Issue 1.0	Jun 2021	Issue for inclusion to Draft Business Plan submission
Issue 1.1	Oct 2021	Reflecting updated DFES forecasts
Issue 1.2	Nov 2021	Reflecting updated CBA results
Issue 2.0	Dec 2021	Issue for inclusion in Final Business Plan submission

Scheme Name	West George Street Primary Fault Level Mitigation		
Activity	Fault Level Reinforcement		
Primary Investment Driver	Fault Level Mitigation		
Reference	ED2-LRE-SPD-003-CV3		
Output	Fault Level Reinforcement		
Cost	£1.340m		
Delivery Year	2024-2026		
Reporting Table	CV3		
Outputs included in ED1	~~Yes~~/No		
Business Plan Section	Develop the Network of the Future		
Primary Annex	Annex 4A.2: Load Related Expenditure Strategy: Engineering Net Zero Annex 4A.6: DFES		
Spend Apportionment	**ED1**	**ED2**	**ED3**
	£m	**£1.340m**	**£m**

SP ENERGY NETWORKS

Technical Governance Process

Project Scope Development

IP1(S)

To be completed by the Service Provider or Asset Management. The completed form, together with an accompanying report, should be endorsed by the appropriate sponsor and submitted for approval.
IP1 – To request project inclusion in the investment plan and to undertake project design work or request a modification to an existing project
IP1(S) – Confirms project need case and provides an initial view of the Project Scope
IP2 – Technical/Engineering approval for major system projects by the System Review Group (SRG)
IP2(C) – a Codicil or Supplement to a related IP2 paper. Commonly used where approval is required at more than one SRG, typically connection projects which require connection works at differing voltage levels and when those differing voltage levels are governed by two separate System Review Groups.
IP2(R) – Restricted Technical/Engineering approval for projects such as asset refurbishment or replacement projects which are essentially on a like-for-like basis and not requiring a full IP2
IP3 – Financial Authorisation document (for schemes > £100k prime)
IP4 – Application for variation of project due to change in cost or scope

PART A – PROJECT INFORMATION

Project Title:	**West George Street Primary Fault Level Mitigation**
Project Reference:	**ED2-LRE-SPD-003-CV3**
Decision Required:	**To give concept approval for the replacement of the existing 11kV switchboards at West George Street primary.**

Summary of Business Need:

West George Street 33/11kV primary substation provides supplies to ca. 966 mainly commercial properties in the city centre of Glasgow. Both make and break fault level duty on the 'A' and 'B' switchboards at 11kV presently exceed the rating of the existing switchgear and there are currently operational restrictions and a derogation in place to manage the risks associated with the high fault level.

In order to comply with section 9 of the Electricity Act and Condition 21 of our licence obligation "to develop and maintain an efficient, coordinated and economical system for the distribution of electricity" an enduring design solution is required in order to satisfy the existing requirements and accommodate future growth and this proposal will meet that requirement.

Summary of Project Scope, Change in Scope or Change in Timing:

The proposal is to replace the existing 22-panels with a new rationalised 11kV board of at least 13.2kA RMS break rating. The new board will comprise of 19-panels, 16 of which are feeder breakers, a single bus section and two incomer breakers, with space for an additional circuit breaker on each side. The replacement of the 11kV board at West George Street primary will be challenging due to its location and space limitation. This project will require a non-standard build due to the complexities of the site and the proposed solution of raising the housing above ground to future proof the site.

The estimated cost for the above is £1.340m (in 2020/21 prices) with 100% contribution to be included in the RIIO-ED2 load related expenditure.

Expenditure Forecast (in 2020/21)

Licence Area	Reporting Table	Description	Total (£m)	Incidence (£m)				
				2023/24	2024/25	2025/26	2026/27	2027/28
SPD	CV3	Fault Level Reinforcement	**1.340**	0.447	0.447	0.447	-	-
SPD	**Total**		**1.340**	**0.447**	**0.447**	**0.447**	**-**	**-**

PART B – PROJECT SUBMISSION

Proposed by	Milana Plecas	Signature	Milana Plecas	Date:	30/11/2021
Endorsed by	Russell Bryans	Signature		Date:	30/11/2021

PART C – PROJECT APPROVAL

Approved by	Malcolm Bebbington	Signature		Date:	30/11/2021

Contents

1 Introduction

West George Street 33/11kV primary group is geographically located in Glasgow city centre in close proximity to mainly commercial properties. The group currently serves 966 customers.

Fault levels at the West George Street primary, 11kV 'A' and 'B' switchboards, already exceed the installed switchgear's fault level design rating and there are currently operational restrictions and a derogation in place to manage the risks associated with the high fault level.

In order to comply with section 9 of the Electricity Act and Condition 21 of our licence obligation "to develop and maintain an efficient, coordinated and economical system for the distribution of electricity".

In order to comply with section 9 of the Electricity Act and Condition 21 of our licence obligation "to develop and maintain an efficient, coordinated and economical system for the distribution of electricity" it is proposed to replace the existing 22-panels with a new rationalised 11kV board of at least 13.2kA RMS break rating. The new board will comprise of 19-panels, 16 of which are feeder breakers, a single bus section and two incomer breakers, with space for an additional circuit breaker on each side. The replacement of the 11kV board at West George Street primary will be challenging due to its location and space limitation. This project will require a non-standard build due to the complexities of the site and the proposed solution of raising the housing above ground to future proof the site.

The estimated cost for the above is £1.340m (in 2020/21 prices) with 100% contribution to be included in the RIIO-ED2 load related expenditure.

Due to the operational restrictions and a derogation in place to manage the risks associated with the high fault level, it is proposed to start the works in 2023/24 and the fault level scheme output will be claimed in 2025/26 at the end of the project. This project will take three years to be delivered due to a non-standard build and challenging location and space limitation. This option would provide 97MVA of fault level headroom on the West George Street HV network.

2 Background Information

2.1 Existing / Authorised Network

The network under consideration is West George Street 11kV primary demand group located in Glasgow city centre. West George Street site is split in two by Pitt Street, with 275kV transmission plant located on the west side and on the east side, a 33kV switchroom (ground floor), an 11kV switchroom (1st floor), 33kV and 11kV cables (basement), control rooms and telecoms (2nd floor), 275/33kV and 33/11kV transformers. The 33kV and 11kV switchgear is contained within a brick building and both of the 33/11kV transformer tanks are encased in a brick noise enclosure. The geographical layout of the site is depicted in Figure 1.

Figure 1. West George Street primary site geographical layout

The existing 11kV network comprises of underground cable. West George Street primary is interconnected at 11kV with St Vincent Crescent, Mitchell Street, Newton Street, Rottenrow B, Grant St and Dundas St as highlighted in purple in Figure 2.

The substation consists of 'A' and 'B' switchboards. Each switchboard consists of 11 panels, 8 of which are feeder breakers, a bus section and two incomer breakers.

West George Street primary substation is served by two 21MVA, Bryce 33/11kV transformers (1963). The HV group is fed from West George Street Grid Supply Point (GSP) via the 33kV network shown in Figure 3. West George Street GSP is a major load centre for Glasgow.

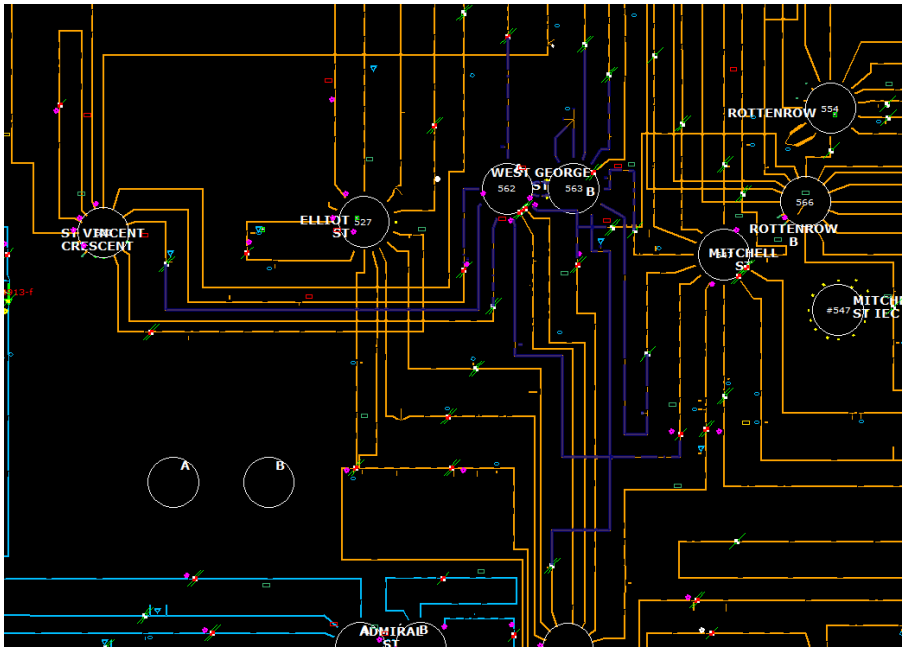

Figure 2. Existing West George Street primary 11kV network

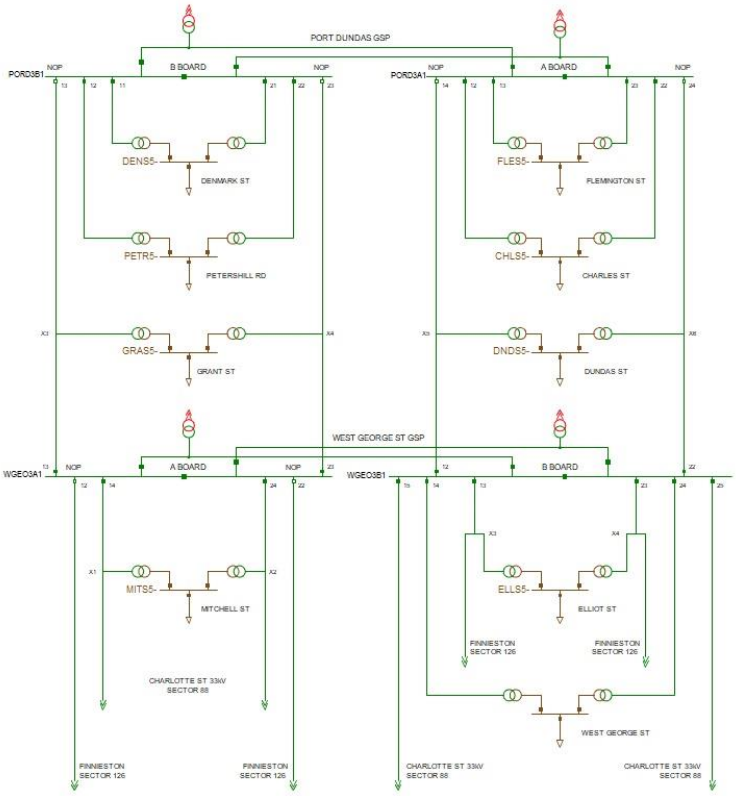

Figure 3. Existing West George Street primary 33kV network

2.2 Network Supply / Circuit Capacity

Historically, the group demand has been in a range of 11.5-15MVA, against the group firm capacity of 21MVA and is load index 1. The group has moved been between a class 'B' and a class 'C' of supply as per ENA Engineering Recommendation (EREC) P2/7.

2.3 Embedded Generation

West George Street primary currently has no HV connected or contracted embedded generation.

2.4 Fault Levels / Design Limits

Switchgear is required to have the capability of "making" fault current i.e. closing onto an existing fault and "breaking" fault current i.e. opening and so disconnecting a fault from the system, these duties are defined in terms of Peak Make and RMS Break.

Typical planning limits for fault level duties on the SPD network are shown in Table 2.1. These are the design limits for the 11kV network.

Table 2.1. Fault level design limits

System Voltage (kV)	3-phase Fault Level Limits (kA)		1-phase Fault Level Limits (kA)	
	Peak Make	RMS Break	Peak Make	RMS Break
HV	32.80	13.12	32.80	13.12

The switchgear fault level duty assessments are based on the SP Energy Networks (SPEN) design policies ESDD-02-006[1], under which the design principles effectively ensure with regards to the equipment duty, the prospective network fault levels shall never be more than 100% of the plant capability. However, to reflect the potential for under-estimation due to generic assumptions and modelling errors, sites exceeding 95% of design rating are considered for mitigation.

Table 2.2 shows the current 11kV 3-phase and 1-phase fault levels as a percentage of the lowest of switchgear ratings / design limits at the West George Street primary substation. The rating of this legacy switchgear is considerably lower than the 11kV fault level design limits.

Table 2.2. West George Street primary fault level (LTDS 2020)

Substation Name	Switchgear Rating (kA)		3-phase Fault Levels (kA)		1-phase Fault Levels (kA)		Max 3-phase and 1-phase Duty (%)	
	Make	Break	Make	Break	Make	Break	Make	Break
West George Street primary	19.68	7.87	23.24	8.32	23.96	8.96	**121.75**	**113.85**

3 Needs Case

Switchgear are network assets which keep the higher voltage network safe in the event of a fault. They safely isolate the faulted section of the network. Switchgear is rated to safely operate with a certain level of fault current. Fault level constraints limit the safe operation of this group.

The 11kV board at West George Street primary was commissioned in 1964 and the switchgear has an RMS break rating of 7.87kA. The 11kV fault level exceeds the equipment rating and hence the site is deemed overstressed.

There are currently operational restrictions and a derogation is in place to manage the fault level issues. None of the equipment is adjacent to exterior walls that could potentially impact the public on

[1] ESDD-02-006 – Calculation of System Fault Levels

the streets adjacent to the substation. Due to the configuration of the building, there is no heightened public risk in the vicinity of West George Street primary substation.

For these reasons, it is necessary to mitigate the existing fault levels, to continue to maintain a safe and secure network.

3.1 Forecast Demand

No other thermal or voltage constraints were identified in the group during the RIIO-ED2 period with the forecast demand growth. With the forecast demand growth, group still operates within the limits of the requirements a class 'C' of supply as per EREC P2/7 and is compliant through the RIIO-ED2 period.

3.2 Forecast Generation

There is no generation forecasted to be connected to West George Street primary based on Distribution Future Energy Scenarios.

3.3 Network Impact Assessment

The West George Street group have been assessed with the forecast demand growth, covering thermal and fault level constraints while considering the different demand forecast scenarios.

3.3.1 Thermal Constraints

No additional thermal constraints have been identified in the group under intact and outage conditions with the forecast demand growth.

3.3.2 Fault Level Constraints

The fault level issues at West George Street primary will persist and continue into RIIO-ED2 and require operational measures to manage the fault level exceedances.

4 Optioneering

Table 4.1 shows a summary of the options considered for this reinforcement. The baseline option represents the lowest cost conventional option, i.e. the minimum level of intervention without application of innovation.

Table 4.1. Longlist of solution options

#	Options	Status	Reason for rejection
(a)	Do nothing	Rejected	Rejected as it does not address the network fault level issues and operational restrictions.
(b)	Intervention plan using only Energy Efficiency	Rejected	Rejected as it does not address the network fault level issues.
(c)	Replace 'A' and 'B' 11kV switchboards with a rationalised 11kV board outside the existing building	Shortlisted as **Baseline** option in Detailed Analysis	
(d)	Replace 'A' and 'B' 11kV switchboards in situ	Rejected	The height of the current 11kV switchroom is not adequate for the new 11kV switchgear and it is not technically feasible to raise the ceiling.
(e)	Replace 'A' and 'B' 11kV switchboards with a rationalised 11kV board inside the existing building	Shortlisted as **Option 1** in Detailed Analysis	
(f)	Install Active Fault Level Management AFLM) with Real-Time Fault Level Monitoring (RTFLM) scheme.	Rejected	Rejected as unable to mitigate the risk of already high fault levels.
(g)	Install an 11kV bus section reactor	Rejected	Rejected due to Transient Recovery Voltages (TRV) when switching the bus section reactor in/out. Upgrading the 11kV primary switchboard would not fully mitigate the issue as current chopping would cause voltage spikes which could damage downstream SPEN and customer equipment.
(h)	Install 11kV series reactors in the tails of the primary transformers	Rejected	Rejected due to Transient Recovery Voltages (TRV) when switching the bus section reactor in/out. Upgrading the 11kV primary switchboard would not fully mitigate the issue as current chopping would cause voltage spikes which could damage downstream SPEN and customer equipment.

5 Detailed Analysis & Costs

5.1 Proposed Option (Baseline) – Replace 11kV Switchboards with a Rationalised 11kV Board Outside the Building

The proposed solution is to replace the existing 'A' and 'B' 11kV switchboards (22-panels in total) with a new rationalised 11kV switchboard within the West George Street site. The new board will comprise of 19-panels, 16 of which are feeder breakers, a bus section and two incomer breakers, with the facility for an additional circuit breaker on each side. Table 5.1 shows the scheme summary.

Table 5.1. Baseline option summary

Category	Scheme Name	Scheme Summary	RIIO-ED2 Contribution (£m)	Customer Contribution (£m)
Conventional	West George Street Primary Fault Level Mitigation	Replace 'A' and 'B' 11kV switchboards with a rationalised 11kV board outside the building	1.340	-

The switchboard replacement creates significant additional fault level headroom West George Street primary as shown in Table 5.2.

Table 5.2. Baseline option fault levels at West George street primary

Substation Name	Design Rating (kA)		3-phase Fault Levels (kA)		1-phase Fault Levels (kA)		Max 3-phase and 1-phase Duty (%)	
	Make	Break	Make	Break	Make	Break	Make	Break
West George Street primary	32.80	13.12	22.75	8.01	23.66	8.8	**72%**	**67%**

The 33kV and 11kV switchgear is contained within a brick building which has ongoing civil issues with the retaining walls and water ingress into the basement. The height of the current 11kV switchroom is not adequate for the new 11kV switchgear and it is not technically feasible to raise the ceiling due to the building structure. In order to future proof the site, it is proposed to remove the current 11kV boards from the existing building and carry out civil maintenance works on area subject to 11kV works only (walls / compound / cable basement area, etc.). It is proposed to do an off-line build with a bespoke civil structure which will raise the switchgear housing on elevated structure. This will allow future asset replacement of the 33kV 'A' and 'B' boards and 33/11kV transformers in RIIO-ED3.

The locations of the new 11kV board and the future 33kV board and 33/11kV transformers have also been discussed and agreed with SP Transmission to ensure there is enough space for installation of a black start generator. The location of the new 11kV board is shown in Figure 4.

This project requires more funding than a standard build due to the complexities of the site and the proposed solution of raising the housing above ground. Civil cost takes cognisance of the engineering difficulty required to work within and around the existing site and to clear off the known defects with the sites existing retaining walls. Planning permissions are also required and associated with approvals with the local council. In order to future proof the site and to vacate the existing building, the cognisance of the inclusion of a new RTU, new comms routes and battery systems have also been included in the cost.

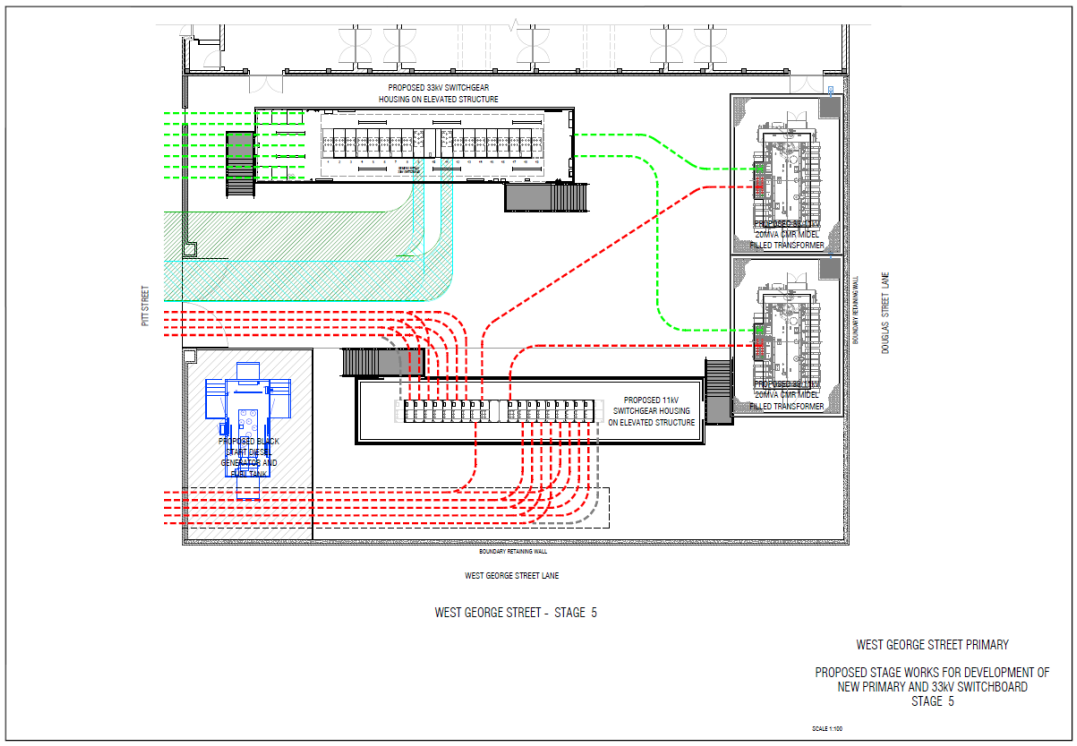

Figure 4. West George Street new 11kV switchboard location

Table 5.3 shows a summary of reinforcement costs and volumes for the proposed scheme under RIIO-ED2.

Table 5.3. Baseline option summary of reinforcement costs and volumes

Asset Description	Volumes	Prime Costs (£m)	RIIO-ED2 Contribution (£m)	Customer Contribution (£m)
6.6/11 kV UG cable	1.5	0.176	0.176	-
6.6/11kV CB (GM) Primary	19	0.527	0.527	-
Batteries at 33kV Substations	2	0.018	0.018	-
Civil Works at 33 kV & 66 kV Substations		0.459	0.459	-
Wayleaves/Easements/Land Purchase		0.050	0.050	-
Other Costs (Identify Below)		0.110	0.110	-
Total Costs		1.340	1.340	-
Identify activities included within other costs (please provide high-level detail of cost areas)				
Planning and design (£50k)				
RTU (£10k)				
Comms route (£50k)				

Due to the operational restrictions and a derogation in place to manage the risks associated with the high fault level, it is proposed to start the works in 2023/24 and the fault level scheme output will be claimed in 2025/26 at the end of the project. This project will take three years to be delivered due to a non-standard build and challenging location and space limitation. This option would provide 97MVA of fault level headroom on the West George Street HV network.

5.2 Option 1 – Replace 11kV Switchboards with a Rationalised 11kV Board Inside the Building

This option considers replacement of the existing 11kV switchboards with a new rationalised 11kV switchboard within the current building. The new board would comprise of 19-panels with the facility for an additional circuit breaker on each side. As the current 11kV switchroom is not suitable for a new 11kV board, this option would require an early replacement of the 33kV 'A' and 'B' boards with a rationalised 33kV board which would be outside the building. This would allow an offline build of the 11kV board in the current 33kV switchroom.

Table 5.4 shows the scheme summary. Although the switchboard replacement inside the building creates the same fault level headroom, at West George Street primary, as in the proposed option, this option is more expensive as it requires an early replacement of the 33kV boards and additional civil works to safely maintain the building.

Table 5.4. Option 1 summary

Category	Scheme Name	Scheme Summary	RIIO-ED2 Contribution (£m)	Customer Contribution (£m)
Conventional	West George Street Primary Fault Level Mitigation	Replace 'A' and 'B' 11kV switchboards with a rationalised 11kV board inside the building	4.128	-

Table 5.5 shows a summary of reinforcement costs and volumes for Option 1 under RIIO-ED2.

Table 5.5. Option 1 summary of reinforcement costs and volumes

Asset Description	Volumes	Prime Costs (£m)	RIIO-ED2 Contribution (£m)	Customer Contribution (£m)
6.6/11kV UG Cable	0.5	0.059	0.059	-
6.6/11kV CB (GM) Primary	19	0.527	0.527	-
33kV UG Cable (Non Pressurised)	1.5	0.299	0.299	-
33kV CB (Gas Insulated Busbars)(ID) (GM)	15	2.504	2.504	-
Civil Works at 33 kV & 66 kV Substations		0.639	0.639	-
Wayleaves/Easements/Land Purchase		0.050	0.050	-
Other Costs (Identify Below)		0.050	0.050	-
Total Costs		4.128	4.128	-
Identify activities included within other costs (please provide high-level detail of cost areas)				
Planning and design (£50k)				

5.3 Options Cost Summary Table

Summary of the costs for each of the evaluated options is presented in Table 5.6.

Table 5.6. Cost summary for considered options

Options	Option Summary	RIIO-ED2 Cost (£m)
Baseline	Replace 'A' and 'B' 11kV switchboards with a rationalised 11kV board outside the building	1.340
Option 1	Replace 'A' and 'B' 11kV switchboards with a rationalised 11kV board inside the building	4.128

Derivation of costs for these options are based on the SPEN RIIO-ED2 Unit Cost Manual for intervention. This is based on bottom up cost assessment of the components of activity detailed within the RIGs Annex A for the above activities, SPEN's contractual rates for delivery, market available rates and historic spend levels.

6 Deliverability & Risk

6.1 Preferred Options & Output Summary

The adopted option is the baseline option replace 'A' and 'B' 11kV switchboards with a rationalised 11kV board outside the building.

6.2 Cost Benefit Analysis Results

A cost benefit analysis (CBA) was carried out to compare the NPV of the options discussed in the previous sections. Considering the lowest forecast capital expenditure, the proposed option has the highest total NPV against other options. The summary of the cost benefit analysis is presented in Table 6.1. The full detailed CBA is provided within 'ED2-LRE-SPD-003-CV3-CBA –West George Street Primary Fault Level Mitigation'.

Table 6.1. Cost benefit analysis results

Options considered	Decision	Comment	NPVs based on payback periods, £m (2020/21 prices)			
			10 years	20 years	30 years	45 years
Baseline – Replace 'A' and 'B' 11kV switchboards with a rationalised 11kV board outside the building	**Adopted**					
Option 1- Replace 'A' and 'B' 11kV switchboards with a rationalised 11kV board inside the building	Rejected	Discounted based on NPV as it requires an early replacement of the 33kV boards and additional civil works to safely maintain the building.	-1.54	-2.12	-2.46	-2.73

6.3 Cost & Volumes Profile

Table 6.2 shows the breakdown of expenditure for the proposed scheme (in 2020/21 prices) and the cost incidence (in 2020/21 prices) over the RIIO-ED2 period is shown in Table 6.3. The total cost of the proposed scheme is £1.340m.

Table 6.2: Summary of reinforcement costs and volumes

Asset Description	Volumes	Prime Costs (£m)	RIIO-ED2 Contribution (£m)	Customer Contribution (£m)
6.6/11 kV UG cable	1.5	0.176	0.176	-
6.6/11kV CB (GM) Primary	19	0.527	0.527	-
Batteries at 33kV Substations	2	0.018	0.018	-
Civil Works at 33 kV & 66 kV Substations		0.459	0.459	-
Wayleaves/Easements/Land Purchase		0.050	0.050	-
Other Costs (Identify Below)		0.110	0.110	-
Total Costs		1.340	1.340	-
Identify activities included within other costs (please provide high-level detail of cost areas)				
Planning and design (£50k)				
RTU (£10k)				
Comms route (£50k)				

Table 6.3: Cost incidence over the RIIO-ED2 period, £m (2020/21 Prices)

Total Investment	Total (£m)	Incidence (£m)				
		2023/24	2024/25	2025/26	2026/27	2027/28
CV3 Expenditure	**1.340**	0.447	0.447	0.447	-	-

6.4 Risks

The switchboard replacement is a BaU activity and hence the risks associated with the delivery of the scheme are very minimal. The past track record for delivery of switchgear replacements is presented in the section 5 of Annex 4A.10: Substations & Switchgear; EHV to LV in our RIIO-ED2 business plan.

The delivery of this scheme will be co-ordinated with the delivery of SPD non-load EHV switchgear modernisation (under CV7) for operational efficiencies and minimize the network impact.

All major connections will be secure during the construction period. However, during the changeover from the existing to the proposed system, the demand associated with individual 11kV circuits will be on reduced security of supply. This risk will be minimised by using an offline build approach and having suitable plans for the reconnection of lost supplies in the event of loss of remaining infeed's during construction outages.

6.5 Outputs Included in RIIO-ED1 Plans

There are no outputs expected to be delivered in RIIO-ED1 that are funded within this proposal.

6.6 Future Pathways – Net Zero

6.6.1 Primary Economic Driver

The primary drivers for this investment based on the maximum short circuit rating of substation equipment being exceeded.

6.6.2 Payback Periods

The CBA indicates that for the proposed option demonstrates better NPV results in all assessment periods (10, 20, 30 & 45 years) against other two options. As the intervention is forecast to carry at least a 45-year asset life expectancy, the CBA at this time justifies the intervention. Consumers will also benefit from reduced network risk immediately on completion of the project.

6.6.3 Sensitivity to Future Pathways

The network capacity and capability that result from the proposed option is consistent with the network requirements determined in line with the section 9 of the Electricity Act and Condition 21. Additionally, the proposed option is consistent with the SPEN's Distribution System Operator (DSO) Strategy and Distribution Future Energy Scenarios.

Table 6.4 shows electric vehicle and heat pump uptakes across a range of future pathways.

Table 6.4: Electric Vehicle and Heat Pump uptakes across a range of future pathways

End of RIIO-ED2	SPEN	DFES			CCC				
	Baseline	System Transformation*	Consumer Transformation	Leading the Way	Balanced Net Zero Pathway	Headwinds	Widespread Engagement	Widespread Innovation	Tailwinds
EVs	19		192	166	23	16	25	23	23
HPs**	0		0	0	0	0	0	0	0

*Note: We have excluded System Transformation from our future pathways assessment as it does not meet interim greenhouse gas emission reduction targets.

**There is no HP uptake in the group as the customer base is industrial / commercial type.

Table 6.5 shows the sensitivity of the proposed solution and Table 6.6 shows the sensitivity of the proposed RIIO-ED2 expenditure against the full ranges of Net Zero complaint future pathways other Climate Change Committee (CCC) scenarios.

Table 6.5: Sensitivity of the proposed solution against future pathways

	RIIO-ED1				RIIO-ED2					RIIO-ED3				
Solution Requirements	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Baseline							R1							
Consumer Transformation							R1							
Leading the Way							R1							
Balanced Net Zero Pathway							R1							
Headwinds							R1							
Widespread Engagement							R1							
Widespread Innovation							R1							
Tailwinds							R1							

R1 – Replace 'A' and 'B' 11kV switchboards with a rationalised 11kV board outside the building

The proposed solution is robust across all pathways. As this is the minimum requirement to mitigate the fault levels in the group, it is expected that it is insensitive to the future pathways and is expected that proposed solution is required under all the future pathways. In all cases this solution is expected to endure beyond RIIO-ED3.

Table 6.6: Sensitivity of the proposed RIIO-ED2 expenditure

	Baseline	Uncertain
RIIO-ED2 Expenditure (£m)	1.340	N/A
Comment	Proposed option	

6.6.4 Asset Stranding Risks & Future Asset Utilisation

Electricity demand and generation loadings are forecast to increase under all scenarios. The stranding risk is therefore considered to be low.

6.6.5 Losses / Sensitivity to Carbon Prices

Losses have been considered in accordance with Licence Condition SLC49 and the SP Energy Networks Losses Strategy and Vision to "consider all reasonable measures which can be applied to reduce losses and adopt those measures which provide benefit for customers". Reasonable design efforts have been taken to minimise system losses without detriment to system security, performance, flexibility or economic viability of the scheme. This includes minimising conductor lengths/routes, the choice of appropriate conductor sizes, designing connections at appropriate voltage levels and avoiding higher impedance solutions or network configurations leading to higher losses.

Losses have been considered as part of this design solution and it has not been necessary to carry out any losses justified upgrades. MWh losses for each of the options have been included within the cost benefit analysis and solution selection was not found to be sensitive to the impact of the carbon cost of losses.

During the evaluation of the options associated with the proposed scheme, we have embedded within the CBA, where data are available, an assessment of the embodied carbon and the associated carbon cost to inform our NPV evaluation. The mass of carbon dioxide emitted (CO2e) during the manufacture of the main equipment deployed to deliver this scheme is estimated to be 56.8 tonnes. The monetised embodied carbon value associated with this emission is £2.9k. It should be noted that the embodied carbon evaluation undertaken has only considered the manufacture and supply of materials. Further collaborative industry-wide work is planned for the RIIO-ED2 price review period to better understand the overall embodied carbon values including, for example installation and commissioning services, decommissioning and disposal activities as well as refurbishment opportunities. More information regarding this can be found in Section 3.1.2 of our Environmental Action Plan[2].

6.6.6 Whole Systems Benefits

Whole system solutions have been considered as part of this proposal. No alternatives have been identified that could be provided through a whole systems solution. The completion of this scheme will maintain the integrity of the distribution network and its enduring ability to facilitate wider whole system benefits.

[2] Annex 4C.3: Environmental Action Plan, SP Energy Networks, Issue 2, 2021.

6.7 Environmental Considerations

6.7.1 Operational and Embodied Carbon Emissions

The West George Street Primary Fault Level Mitigation programme has the potential to impact on the embodied carbon resulting from the delivery of the programme. There is likely to be little or no impact on SPEN's Business Carbon Footprint (BCF).

6.7.2 Supply Chain Sustainability

For us to take full account of the sustainability impacts associated of the West George Street Primary Fault Level Mitigation programme, we need access to reliable data from our suppliers. The need for carbon and other sustainability credentials to be provided now forms part of our wider sustainable procurement policy.

6.7.3 Resource Use and Waste

The West George Street Primary Fault Level Mitigation programme will result in the consumption of resources and the generation of waste materials from end of life assets.

Where waste is produced it will be managed in accordance with the waste hierarchy which ranks waste management options according to what is best for the environment. The waste hierarchy gives top priority to preventing waste in the first instance, then preparing for re-use, recycling, recovery, and last of all disposal (e.g. landfill).

6.7.4 Biodiversity / Natural Capital

The West George Street Primary Fault Level Mitigation programme will only affect a single named site containing existing assets. Therefore, the impact on, and the opportunity to improve biodiversity and natural capital is expected to be minimal.

6.7.5 Preventing Pollution

SPEN will always follow all relevant waste regulations and will make sure that special (hazardous) waste produced or handled by our business is treated in such a way as to minimise any effects on the environment.

6.7.6 Visual Amenity

SPEN continually seeks to reduce the landscape and visual effects of our networks and assets but recognises that the nature of our substations makes it challenging to minimise their visual impact.

6.7.7 Climate Change Resilience

In addition to our efforts to minimise our direct carbon emissions in line with our Net Zero ambitions, we are also conscious of the need to secure the resilience of our assets and networks in the face of a changing climate. We have also modified our policy on vegetation control in the face of higher temperatures and longer growing seasons.

7 Conclusion

West George Street 33/11kV primary group is geographically located in Glasgow city centre in close proximity to mainly commercial properties. The group currently serves 966 customers.

Fault levels at the West George Street primary, 11kV 'A' and 'B' switchboards, already exceed the installed switchgear's fault level design rating and there are currently operational restrictions and a derogation in place to manage the risks associated with the high fault level.

In order to continue to maintain a safe and secure network, the proposed fault level mitigation solution is to replace the existing 'A' and 'B' 11kV switchboards (22-panels in total) with a new rationalised 11kV switchboard within the West George Street site.

The estimated cost for the above is £1.340m (in 2020/21 prices) with 100% contribution to be included in the RIIO-ED2 load related expenditure.

Due to the operational restrictions and a derogation in place to manage the risks associated with the high fault level, it is proposed to start the works in 2023/24 and the fault level scheme output will be claimed in 2025/26 at the end of the project. This project will take three years to be delivered due to a non-standard build and challenging location and space limitation. This option would provide 97MVA of fault level headroom on the West George Street HV network.